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# The new post-mining energy landscapes in the lignite basin of Lower Lusatia (Germany)

MICHEL DESHAIES

## Abstract

Since the German reunification in 1990, the landscapes of lignite basins in East Germany, shaped by opencast mining underwent a profound transformation resulting from the closing of most mines. While lakes were formed in ancient flooded excavations, huge mining wasteland areas were reforested or used to implement wind farms and photovoltaic parks at the origin of new energy landscapes. The first wind farms settled in the 1990s in Lusatia were located on mineral mining wasteland which became a potential resource for renewable energy. As a result of the accelerated energy transition policy since 2011, new repowering projects were launched. These projects are developed in a different context because of changing mining wasteland which were meanwhile reconquered by nature and are home to a wide variety of protected migratory birds. This development was favored by the establishment of an International Building Exhibition dedicated to supporting the idea of social renewal by designing new landscapes. Despite the new social and environmental challenges, these projects led by private investors were carried out without public opposition on lands owned by a public company responsible for rehabilitating mines. They have led to a new image and new values given to mining landscapes. The analysis of both previous researches and studies for the installation of wind farms, as well as in-depth qualitative interviews with locals and different stakeholders involved in the development of renewable energy projects, provides lessons for understanding the processing of mining landscapes in post mining landscapes where renewable energy occupy an essential place.

*Energy landscape; lignite basin; post mining landscape; renewable energy; Germany; new Länder*

## Zusammenfassung

### Die neuen Bergbaufolgelandschaften der Energie im Braunkohlenrevier der Niederlausitz (Deutschland)

Seit der deutschen Wiedervereinigung im Jahre 1990 – und bedingt durch die Schließung der meisten Bergwerke – erlebten die vom Braunkohlentagebau stark geprägten Braunkohlengebiete Ostdeutschlands eine tiefgreifende Veränderung. Während in alten überfluteten Tagebauen Seen geschaffen wurden, entstanden auf riesigen aufgeforsteten Bergbaubrachen durch den Bau von Wind- und Photovoltaik-Parks neue Energielandschaften. Die ersten Windparks, die in den 1990er Jahren in der Lausitz errichtet wurden, befanden sich auf den Bergbaubrachen und waren Grundlage für die Erzeugung erneuerbarer Energien. Infolge der beschleunigten Energiewende seit 2011 wurden neue Repowering-Projekte ins Leben gerufen. Diese Projekte entwickelten sich unter veränderten Rahmenbedingungen, weil das Bergbau-Ödland mittlerweile von der Natur zurückerobert wurde und heute eine Vielzahl von geschützten Zugvögeln beherbergt. Diese Entwicklung wurde durch die Gründung einer Internationalen Bauausstellung begünstigt, die die Idee der sozialen Erneuerung durch die Gestaltung neuer Landschaften unterstützt. Trotz der neuen sozialen und ökologischen Herausforderungen wurden diese von Privatanlegern geführten Projekte ohne öffentlichen Widerstand auf Grundstücken durchgeführt, die sich im Besitz eines öffentlichen Unternehmens befinden, welches für die Sanierung der Bergbaufolgelandschaft zuständig ist. Diese Projekte haben zu einem neuen und verbesserten Image der Bergbaulandschaften beigetragen. Die Analyse der bisherigen Untersuchungen und von Untersuchungen über die Umweltwirkungen von Windparks, sowie qualitative Interviews mit Einheimischen und verschiedenen Stakeholdern, die an der Entwicklung von Projekten der erneuerbaren Energien beteiligt sind, leisten einen Beitrag zum besseren Verständnis der Entwicklung von Bergbaufolgelandschaften, in denen erneuerbare Energien eine wesentliche Rolle spielen.

*Energielandschaften; Braunkohlebergbaugesamt; Bergbaufolgelandschaft; erneuerbare Energie; Deutschland; neue Länder*

## Introduction

The economic transformation that followed the fall of communism led to a rapid and profound decline in mining activities throughout Central Europe because existing economic structures were unable to cope with a free market economy (FÖRSTER 1996; WIRTH et al. 2012). In the former GDR, the context created by reunification led to a real collapse of these mining activities, most of which were closed in the early 1990s (WIRTH a. LINTZ 2006). Whole regions, which for more than a century had been shaped by Mining, have suddenly entered a sort of lethargy resulting from the closure of mines, of which very few have remained in operation. In all mining regions, the end of mineral exploitation caused a number of similar problems, “the unavoidable socio-economic drama of pit closure” (BAETEN et al. 1999; WIRTH a. LINZ 2007; WIRTH et al. 2012).

Unlike the coal basins of Western Europe, where the gradual decline in mining activities led to the emergence of new activities and a more or less successful re-development, the mining regions of the new *Länder* came very brutally into the post-industrial era (FÖRSTER 1996). It took overnight to attempt to rehabilitate a very degraded environment on an unprecedented scale, as the exploitation of the Communist era was particularly devastating, while the closure of almost all mines and related industrial activities had multiplied (DESHAIES 2007). The mining regions thus inherited from these transformations an unattractive landscape where, in the 1990s, bare wastelands predominated widely. The particularly disastrous image of these regions seemed to embody all the problems generally attributed to the old declining industrial regions (SCHRADER 1993; GELHAR 2010; WIRTH et al. 2012): environmental degradation and disturbed landscapes, inadequate retraining, high unemployment, loss of identity of the population, demographic decline. More than many other former industrial regions, these mining regions in the new *Länder* seemed to



Fig. 1: Coal and lignite basins in Germany

have no future, because they could not find new activities and above all they could not change an image symbolized by disturbed landscapes and degraded environment. However, very important efforts have been made with extensive state support to change the image and to rehabilitate the landscapes of most of the former mining regions (WIRTH a. LINTZ 2006; LINTZ a. WIRTH 2009). Outside the former uranium mining areas (DESHAIES 2006), these efforts were concentrated on the lignite mining regions, which was the largest mining activity in the GDR.

Since the German reunification, the landscapes of the lignite basins in East Germany, shaped by open cast mining underwent a profound transformation resulting from the closing of most mines. The considerable spatial extension of mining wasteland areas in the early 1990s made it necessary to conduct a rehabilitation program which consisted in reforesting large areas and flooding residual excavations to further build an entire lake landscape still in development. At the same time, the question also arose of new uses to find for these old mining



areas in places very hardly hit by the collapse of mining and industrial activities. It is in this context that the first wind farms were set up on mining wasteland areas in the late 1990s; these areas became a potential resource for renewable energy and all this quite symbolically marked the economic and landscape changes of the energy transition. The landscapes of the Lower Lusatia which still bear the imprint of deep mining have indeed rapidly transformed into new lake and forest landscapes dominated by one of the largest concentrations of wind turbines in Germany. It is on this new image, whose

emergence was favored in the 2000s by organizing an international architecture exhibition that the lignite basin of the Lower Lusatia region is trying to build an economic future.

After presenting the characteristics of the mining landscape inherited from the massive exploitation of the era of the GDR, the article discusses the conditions under which the projects leading to the creation of a new energy landscape developed. The analysis of the studies for the installation of wind farms, as well as interviews with residents and key stakeholders involved

in the development of renewable energy projects provide lessons for understanding the processing of mining landscapes in post mining landscapes where renewable energy plays a major role.

### The mining landscapes to be remediated

State almost devoid of energy resources other than lignite, GDR has strongly developed the extraction of this poor-quality fuel which exceeded 300 million tons per year in the late 1980s. Extracted in huge open-cast mines in the areas of Leipzig and Lower Lusatia (Fig. 1), lignite is the cause of devastation of large areas. Indeed, if after the end of the operations there were plans to rehabilitate and to recultivate, or to reforest mining brownfields, in fact from the 1980s, the focus on production and the lack of financial resources reduced the remediated surfaces which were much lower than those affected by the progression of the mines (BERKNER 1989; 2000; SCHULZ 2005). When communism fell in 1989, barely half of the 120,000 ha of agricultural or forestry land used was the subject of a remediation because the productivist logic strictly in force in the GDR had overshadowed the need for making new landscapes after lignite mining (DESHAIES 2007, 2011). Also in 1989, the landscapes in the lignite basins were characterized by the predominance of vast mineral brownfields plowed by giant excavators (Fig. 2).

Main lignite mining center of the country, the Lower Lusatia basin was also the most marked by the remediation deficit, as production had kept increasing since the 1960s to a peak of 200 million tons in 1988, at a time when the resources were too scarce to ensure the re-cultivation. The continuity of the lignite layers allowed the widespread use of conveyor-bridges, so that the mining surface of Lower Lausitz extended to a much greater speed than in other basins, while the re-cultivation could not keep pace (BERKNER 1989; BAYERL 2011).

Between 1970 and 1990 the areas which were exploited for the extraction of lignite

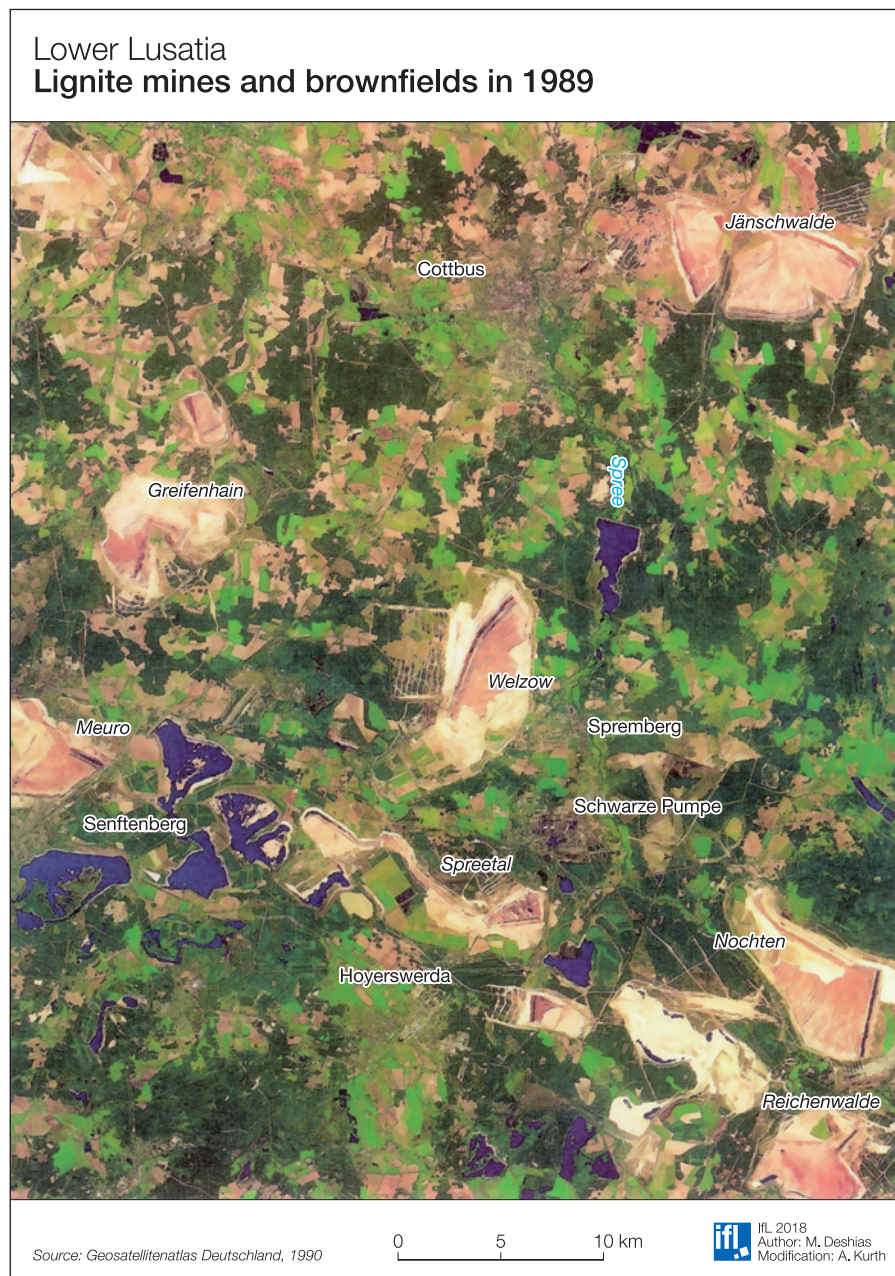


Fig. 2: Lignite mines and brownfields in Lower Lusatia in 1989

in Lower Lusatia almost doubled, from 37,578 to 70,578 ha. In the eighties, more than 2,000 ha per year were consumed by mining. While in the seventies, the remediated areas were almost equivalent to that consumed by operations, in the eighties, only half of the surfaces was undergoing remediation (refer to Tab. 1). More than in central Germany, the landscapes of Lower Lusatia were thus marked by huge plowed surfaces, totally mineral, corresponding to mine spoils left by the conveyor bridges (Fig. 2). Of the 75,000 ha exploited since the early days of mining in Lower Lusatia, in 1992 there were more than 36,000 ha corresponding to active mines, to residual cavities, or brownfields that had not yet been remediated (GEORGI 1994).

After the reunification in 1990, lignite mining was privatized, reorganized and most of the mines were closed as a result of the sharp decrease in volumes extracted which are now around 70 million tons per year in three open-cast mines still in operation. The federal government took over the remediation of mining wasteland through public companies combined in 1994 to form the LMBV (*Lausitzer und Mitteldeutsche Bergbauverwaltungs-gesellschaft mbH*). The LMBV is a public company belonging to the Bund which is responsible for remediating former lignite mines in Eastern Germany. After the remediation of mining areas, it may also sell them to buyers. Since 2007, its headquarters are in Senftenberg, in the Lower Lusatia basin.

The results of the rehabilitation of mining wasteland in 2013 were already impressive since in 20 years more than 16,000 ha (or 20% of the total area mined since the nineteenth century), were converted (*Wiedernutzbarmachung*), mainly by planting forests (8000 ha) for half of the surfaces and by forming lakes (4,300 ha) in residual open pits (refer to Tab. 1). However, few new surfaces (approximately 1000 ha) have been converted to agriculture because of poor soils and the restructuring of agriculture in the new Länder. Areas assigned to other uses (additional 3300 ha) have progressed. These include the development of new activity parks, leisure parks,

Lower Lusatia Exploited and remediated areas							
Year	Exploited areas [ha]	Active mines and not remediated areas [ha]	Remediated areas [ha]	Agriculture [ha]	Forests [ha]	Existing lakes [ha]	Other uses [ha]
1989	68 671	31 891	36 780	7 646	21 460	2 916	3 725
1992	74 744,9	36 530,3	38 214,6	8 743,7	22 631,9	3 204,2	3 634,8
2002	80 831	34 375,5	46 455,5	9 329	28 050,1	3 555,9	5 520,3
2013	86 592	31 877,6	54 714,4	9 880,1	30 374,2	7 545,9	6 914,2

Source: LMBV (*Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft mbH*)

Tab. 1: Exploited and remediated areas in Lower Lusatia

or the implantation of photovoltaic parks and wind farms which illustrate the formation of a new post-mining landscape.

### The creation of a new post-mining energy landscape

Given the scale of abandoned mining areas and the need to rebuild acceptable living conditions in a region devastated and heavily hit by the economic collapse which followed the reunification, the LAUBAG, and from 1994 the LMBV has developed a comprehensive remediation program conducted by conventional methods proven for decades (PFLUG 1998): cleaning up old mine sites, reshaping the open-cast mines to stabilize embankments, doing the re-vegetation work, reforestation and re-cultivating mining brownfields. By the late 1990s the new post-mining landscape, composed of large lakes in residual cavities and new forests planted on mine spoils, began to emerge. At the same time, faced with the disappearance of most of the lignite jobs (in 2013 there was still 8000 jobs in the lignite sector in Lower Lusatia against 75,000 in 1989), the question also arose of creating new activities and therefore how to use the remediated surfaces. LMBV mission was to support the reuse of these spaces by searching for investors for new activities. The municipalities and the two Länder sharing the Basin, Saxony and Brandenburg, were interested in the fact that the remediation would help in particular to develop the attractiveness of their territory (LINTZ a. WIRTH 2015). Thus the idea gradually emerged among local actors

to exploit the opportunity offered by the constitution of a new landscape to develop new activities completely different from those of the industrial past.

If logging covers most of the remediated areas, dozens of new lakes have been created, the largest of which extend over several hundred hectares and this allowed to consider a new touristic future around these water bodies (Fig. 3 and Fig. 4) which have been managed successfully with respect to water quality (SCHULZE et al. 2010). On most lakes already completed or being completed, many development projects of beaches, water sports, "natural" protected areas (*Naturschutzgebiet*), touristic reception facilities and marinas have been completed. Extensive mining brownfields were locally refurbished to serve as support to new uses such as the automobile circuit of *Eurospeedway Lausitz* opened in August 2000 and which is intended to American speed races. As part of the remediation process of mining brownfields, an original initiative resulted in the creation of a botanical garden and a geological trail (*Findlingspark*) on boulders extracted from mine spoils along the Nochten open-cast mine.

The new lake landscape in Lower Lusatia<sup>1</sup> already largely established in the western part of the basin, around the town of Senftenberg, has been promoting itself as a new

<sup>1</sup> Lausitzer Seenland: <http://www.lausitzerseenland.de/de.html>



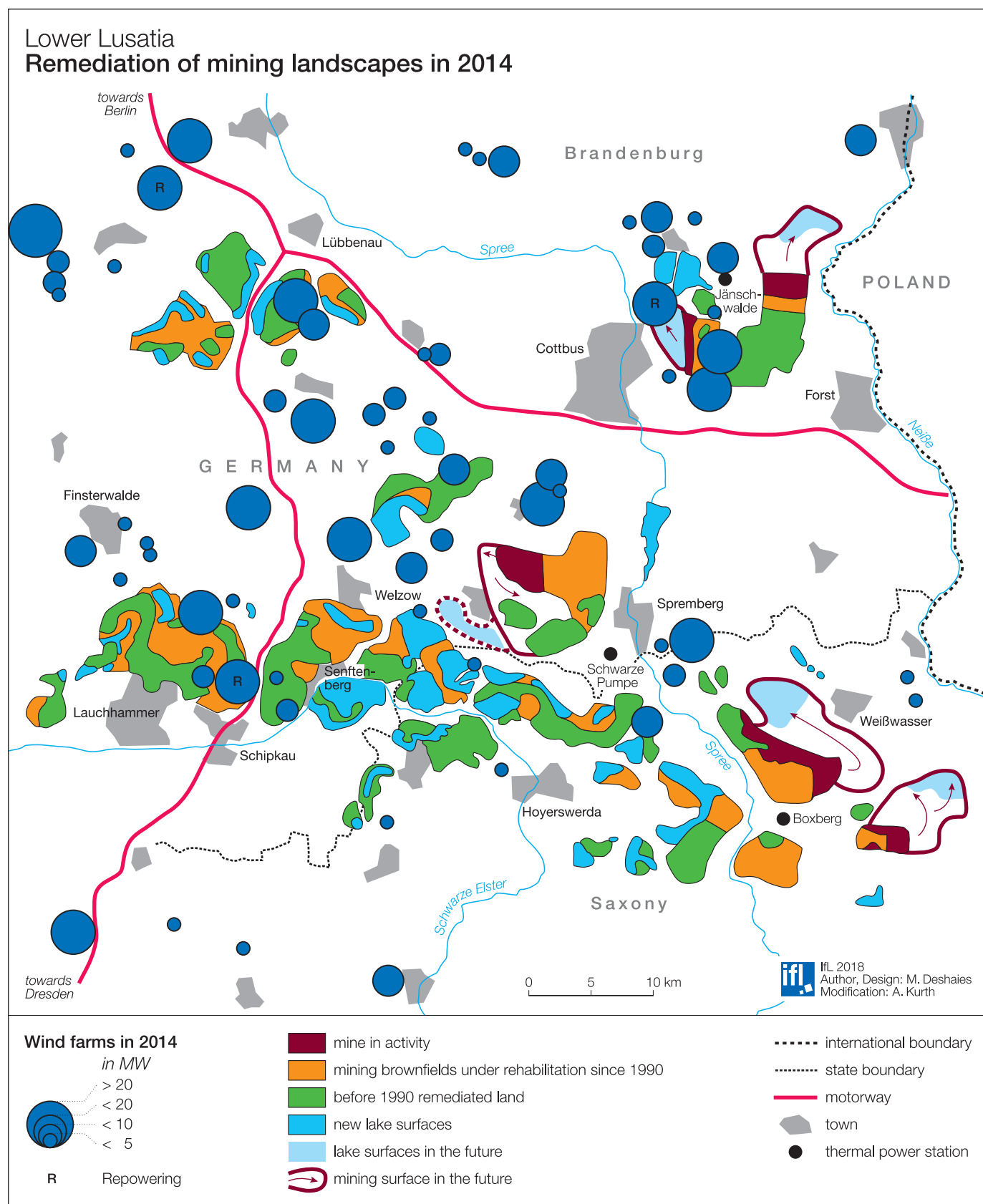


Fig. 3: Remediation of mining landscapes in Lower Lusatia in 2014



Fig. 4: The new lake in completion in the former open cast mine Meuro (Deshaies 2018)

touristic destination for several years. The originality of this region is that it offers both a high potential for beach and water sports, but also a wide range of possibilities for active holidays (cycling, skate, horse or quad), or on the traces of the industrial heritage (the giant conveyor-bridge of the former open-cast mine of Klettwitz (Fig. 5), or the old thermal power plant Plessa). Since 2015 the lakes created in the former lignite mines around Senftenberg have been interconnected by channels; this allows for a real cruise from one lake to another.

In just a few years, this lake region has become an emerging tourist destination, promoted and coordinated by the *Tourismusverband Lausitzer Seenland*, resulting from the merger in 2012 of the trade unions created in 2002 in Brandenburg and in 2004 in the Saxon part. The construction of this new lacustrine landscape has encouraged the development of cooperation between the different municipalities. Attendance,

which is still modest, is nevertheless growing strongly, amounting to more than 644,000 overnight stays in 2017, compared to around 500,000 in 2014. The goal is to reach 1.5 million overnight stays by 2020 when most lakes will have reached their final level.

While lakes under construction are being more and more used for touristic and recreational activities, the development of renewable energy policy in Germany has given new value to old mining areas. By the end of the 1990s, it was begun to consider using brownfields to install new renewable energy infrastructure, particularly wind turbines, which must always be located away from homes and protected natural areas. The state of Brandenburg has been a forerunner, in line with its desire to develop renewable energies. After setting fairly modest targets in 2002 (5 % renewable energy in 2010), the “energy strategy” of 2008 set a 2020 target of 20% renewable

energy in primary energy consumption. To achieve its objectives, it has relied heavily on biomass and wind power. On the other hand, the state of Saxony remains to this day, especially for wind turbines whose installed capacity is five times lower than that of Brandenburg.

This is why the wind turbines are located mainly in the Brandenburg part of the lignite basin (Fig. 3). Since the LMBV sold 1500 hectares of mining brownfields to install wind farms, the inclusion of renewable energy took place in two steps in the region of Schipkau: between 1999 and 2006, the implementation of fifty wind turbines with an installed capacity of about 100 MW. The establishment of the first wind turbines in 1999 was a direct response to the results of the study commissioned by the Land of Brandenburg in 1996 and published on the possibilities of building wind turbines on mine spoils. In particular it stressed the large wind potential that existed at the top





Fig. 5: The old conveyor-bridge in the mine Klettwitz: the "lying Eiffel Tower" (Deshaies 2013)

of mine spoils trays and particularly those overlooking the village of Klettwitz (town Schipkau), considered one of the best sites of all Brandenburg.

The high availability of surfaces has also been seized by investors in photovoltaics, especially following the amendment of the EEG (*Erneuerbare Energien Gesetz*) on renewable energy from 1st April 2000 (which established an advantageous purchase tariffs system for 20 years for renewable energy producers) in 2009, which limited the possibilities of locating the PV parks on conversion surfaces as brownfields and mining. The LMBV then established an inventory of areas which may be suitable for the installation of PV parks and sought investors. In the region of Schipkau, this led in 2011 to the implementation of several large photovoltaic parks on mining wasteland of the former Meuro operations that extend to both the

municipalities of Schipkau, Großräschen and Senftenberg (Fig. 6). Added to this are the recent installation of PV systems in the parking lot of the racing ring Lausitz (Eurosportway Lausitz) and the building next to the most powerful on-shore wind in the world (7 MW).

Using these mining brownfields under rehabilitation process by LMBV posed technical problems especially since it was first necessary to verify that the detrital material constituting the mine spoils has sufficient coherence to be able to anchor the turbines which reach a nacelle height of 70 m. The installation of these wind farms, the first in the region, was perceived very favorably by LMBV because it brought a justification to the huge investments made since the reunification to rehabilitate mining brownfields which might seem disproportionate in a Germany in a difficult economic situation at that time. The demographic and economic decline of

East Germany made very hypothetical the possibility to reuse such vast surfaces for new economic activities. Also, the development of wind farms and more recently of photovoltaic parks illustrate new forms of recovery that we could find for these surfaces which recently no one knew what to do with.

### **New images and new challenges of a changing landscape**

These forms of rehabilitation and conversion of the region, however, seemed unsatisfactory to the extent that they eventually resulted in the almost total disappearance of the legacies of past mining and therefore to a certain trivialization of the landscape. It seemed necessary to develop concepts for preserving the cultural heritage of the mining region (WIRTH et al. 2012). Since the 1990s mining and industrial heritage have become elements of cultural heritage which can help to develop tourism (SOYEZ 2006; GELHAR 2005,





Fig. 6: Large photovoltaic parks on mining wasteland of the former mine Meuro (Deshaies 2018)

2010). One of the best known examples was developed through the framework of the so-called “*Internationale Bauausstellung*” (IBA, International Building Exhibition) Emscher Park in the Ruhr District. From 1989 to 1999 a total of 89 ecological or cultural restructuring projects were realised in the framework of the IBA Emscher Park and were seen as a necessary for renewal of the Ruhr District (KILPER a. WOOD 1995; SHAW 2002; ECKART et al. 2003).

Also, in imitation of what had been achieved in the Ruhr area in the nineties, the politicians of the Lausitz-Spreewald region, supported by the government of the Land Brandenburg, created a IBA; that is to say, a company responsible for initiating, coordinating and ensuring the promotion of projects for the remediation and enhancement of heritage and landscapes developed in the region. The Government of Saxony only participated in

the IBA for the Lausitzer Seenland. From 2000 to 2010 the *IBA Fürst Pückler Land* helped to reveal a new landscape (*Neue Landschaft*) and especially a new image of the Lower Lusatia basin (IBA 2010); the logo of the IBA, See (lake in German) playing on its English meaning: to see. Thirty projects grouped in nine skilled areas of „landscape islands“ were thus initiated by the IBA (DESHAIES 2011).

These projects are divided according to different themes representing both the industrial and mining heritage and the future of landscapes in Lower Lusatia. Indeed, the IBA has integrated the fact that as a result of the gradual flooding of old mines, the landscape would change much in the coming decades and that it was therefore necessary to exploit this uniqueness to transform the image of the region, while maintaining its identity elements (IBA 2010). Several ‘monuments’ bearing witness to the history of mining

and processing of lignite have been well preserved and even staged as the old conveyor-bridge in the mine Klettwitz become “lying Eiffel Tower” (Fig. 5), or the bio-towers (*bio-Türme*: Coke production produced large amounts of phenol-rich waste water. This was purified in the so-called tower dripper facility wastewater purification facilities with the help of bacteria: the Bio-Towers) of the former coking plant Lauchhammer. The lake scenery being created inspired new concepts that IBA has sought to achieve in order to give a new image to the region. The idea of a navigable link channel between the lakes has emerged during the IBA. It has also developed the insertion of new floating architectures on flooding lakes and the creation of “*Landmarken*” which served as viewing towers on new water landscapes. In one of the few open-cast mines still in operation, that of Welzow, ephemeral landscapes of mine spoils being gradually spontaneously vegetated were used



Fig. 7: New wind farms on mining wasteland of the former mine Klettwitz (Deshaies 2015)

to support an original project of discovery tourism. The organized tours<sup>2</sup> in which visitors are invited to share the emotions that the rebirth of nature on mining brownfields inspires, is the highlight of this new tourism concept. The new energy landscape which has emerged since the late 1990s has also inspired one of the projects of the IBA with the idea to use part of mining brownfields remediated for the cultivation of energy crops, particularly of fast-growing trees whose potential is the subject of a study by the University of Cottbus, in partnership with the mining company Vattenfall.

At the end of the IBA in 2010, energy even became a unifying theme between different sites of the Lower Lusatia basin through the implementation of the Energy

Route of Lusatian Industrial Heritage<sup>3</sup>. This new touristic route which is attached to the European Route of Industrial Heritage<sup>4</sup> acts as a network of ten sites representative of extracting and processing brown coal for energy production. Most sites are an industrial heritage since it is old briquette factories (Briquetterie Louise, Energiefabrik Knappenrode), ancient thermal power stations (Plessa), Bio-Türme in Lauchhammer, or the conveyor bridge in the open cast mine of Klettwitz. But the originality of the road is that it also includes sites in activity as the new Schwarze Pumpe thermal power station and the lignite mine Welzow where excursions on foot, bicycle, or all-terrain vehicles are offered.

Deeply transformed by the extraction of lignite, the landscapes of Lower Lusatia are acquiring a new identity, because when mining ceases in 2030, the region will become a lake and wooded country with 50,000 ha of forest and more than 140 lakes extending over 26,000 ha, or one quarter of former mining areas. These landscapes will not only be similar to those inherited from the glaciation in Mecklenburg-Vorpommern and Finland; they will also be characterized by the omnipresence of renewable energy, particularly wind power, whose development is continuing.

In recent years and especially since the Fukushima disaster in 2011 which gave additional impetus to the energy transition, many new wind farms were created or are being built throughout Lower Lusatia, or on mining brownfields, or nearby. The old turbines Klettwitz/Schipkau

<sup>3</sup> Route der Energie Lausitzer Industriekultur: <http://www.energie-route-lausitz.de/>; see also <http://www.iba-see2010.de/de/projekte/projekt24>

<sup>4</sup> ERIH: <http://www.erih.net/de/regionale-routen/deutschland/lausitz.html>

<sup>2</sup> <http://www.bergbautourismus.de/Besucherzentrum/>



in 2014/2015 were dismantled to be replaced by 27 wind turbines twice as powerful; which is the largest repowering project (repowering involves the replacement of old wind turbines by new, more powerful wind turbines in order to increase production) in Germany (Fig. 7). There are also plans to develop new wind farms on mining and often reforested areas located near existing parks. If these plans are carried out, the majority of mining areas of the former lignite open cast mine of Klettwitz will have been used for the development of wind power. Thus, alongside the chimneys and cooling towers of thermal power plants which have dominated the landscape until now, the wind farms are becoming characteristic elements of the lignite basin landscape (Fig. 3). These wind projects have received broad local support and there was no problem of acceptability as shown by a survey of the population in Klettwitz (municipality Schipkau).

As most people consider that the exploitation of lignite has had a negative impact on the landscapes of the region, the nuisances created by the wind turbines are considered to be relatively moderate. When carrying out the repowering project in 2014: 2015 only eight letters of dispute were sent to the municipality. This is much less than in the first wind project in 1998, when more than 80 people expressed their opposition to the installation of the wind turbines. The municipality insists on what appears to be a kind of dynamic that contrasts with the situation in the years following the reunification. Fifteen years ago, it was the decline, almost half of the population lost their jobs with the closure of lignite mines. In addition, the local landscape framework was strongly marked by very extensive mining brownfields. The development of renewable energies appeared as "the first positive thing new in the region since reunification" (municipality of Schipkau in Mai 2013). They brought hope, although there was little effect on the employment market.

More importantly, perhaps in terms of image, this area once heavily polluted by emissions of sulfur dioxide from power plants and literally devastated by operating open cast mines is in the process of reconstructing a "greener" image. It already enjoys a pleasant environment with many lakes being created in the former lignite mines which even become "natural" areas attractive to migratory birds. It is the existence of this new lake environment that was the main critical point for the installation of the new wind turbines. Indeed, in the Klettwitz survey, some people pointed out that if the first wind turbines were installed in the late 1990s on mined wastelands with no natural stake, this was no longer the case for the new repowering project. The few opponents of the repowering project highlight in particular the visual impact of the new wind turbines, which are much higher than the old ones (up to 200 m at the top of the blades instead of 110 m) for land which has largely become recreational areas close to bike paths and renaturated areas. In fact, with the rise in the level of the lakes and the progress of renaturation, these old mines are now "rich natural spaces with many birds that should be better protected by avoiding the multiplication of wind turbines" (a citizen from Klettwitz interviewed in Mai 2014). The fear was even expressed by one of the interviewees that the new repowering project is only a first step before other projects. "There are potentially a lot of places available that could accommodate wind turbines, but at the cost of a degradation of the quality of the landscapes and nuisances for the inhabitants and the fauna."

The development of renewable energy through the installation of wind farms and photovoltaic parks participates in the construction of this new image of the region which has become one of the largest in Germany in the production of "green" electricity. The Lausitz-Spreewald region that covers the entire Lower Lusatia lignite basin and the surrounding countryside is also part

of the network of areas with 100% renewable energy. The project regions to 100 % renewable energy<sup>5</sup> is an initiative of the environmental Ministry (BMU) launched in 2007, to identify local factors success of the energy transition and to disseminate these results in the regions. In this densely populated area of 630,000 inhabitants, the production of electricity from renewable energy is higher than the consumption, two-thirds coming from the wind farms. However, it should be noted that the share of renewable energy remains low compared to that of two local lignite power plants, which, with about 42 TWh in 2015, provide about 90 % of electricity production, most of it to supply the large urban centers like Berlin. To what extent will the future development of new renewable generation capacity be able to replace a significant part of the production of lignite power plants, it remains for the moment still largely a query.

## Conclusion

Those who still have in mind the image of landscapes devastated by lignite mining in the Lower Lusatian basin in 1989, will struggle to recognize the current landscape of the region. The twenty-five years that have passed since the German reunification and the collapse of lignite production have led to significant transformations of the landscapes. The closure of most mines allowed to hire a large remediation program of mining brownfields and build a new landscape dominated by forests and vast lakes. But these changes are not limited to the physiognomy of the landscape as the organization of an International Building Exhibition (IBA) has led to the emergence of new concepts embodied by projects to give meaning to these changes and forge a new image of the region. Lower Lusatia is thus in the process of finding a new identity as a touristic area around three main concepts that have come out of the IBA period: the new lake surfaces, the staging of industrial

<sup>5</sup> <http://www.100-ee.de/>



heritage and new energy landscapes. It is precisely the combination of these three elements which is now the originality of this region (BAYERL 2011). This strategy for reorganizing the mining region through the rehabilitation of landscapes has to combine ecological rehabilitation and sustainable socioeconomic development (WIRTH a. LINTZ 2006; WIRTH et al. 2012).

However, it is uncertain whether this is sufficient to enable a revival of a region whose decline in population is inevitably continuing. In twenty years, between 1993 and 2014, the Lower Lusatia basin lost more than a quarter of its population from 500,000 to 365,000 inhabitants (this trend is calculated from the population of the two main cities, Cottbus and Hoyerswerda, as well as that of the two Landkreise of Spreeneiße and Oberspreewald-Lausitz). Far from slowing down compared to the evolution of years following the reunification, the recent decline in the population has remained as important as in the 1990s. Between 2010 and 2014 the region lost an average of 6,000 inhabitants per year. According to forecasts by the statistical services, the region could lose more than 60,000 inhabitants between 2015 and 2030. The definitely much more positive image of the region and the new activities are insufficient to stem the departure of fewer and fewer young people, while the aging population is already very high. Added to this is the new uncertainty that the announcement by Vattenfall created in 2016: the lignite mining company decided to sell all of its mines and its thermal plants to the Czech Company ETH. Despite the sharp decline in this sector since the reunification, it is still the main employer in the region (with 8,000 thousands direct jobs and 16,000 thousands indirect jobs) and a further reduction of lignite production would have major consequences on employment. If the image of the Lower Lusatia is now less and less associated with lignite, it is too early to definitively

abandon the exploitation of what was its wealth for over a century and a half.

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## Резюме

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### Новые энергетические ландшафты в заброшенных горнопромышленных районах угольного бассейна Нижней Лужицы (Германия)

После объединения Германии в 1990 году и закрытия большинства горнодобывающих предприятий бурого угля, претерпели радикальные изменения. Старые угольные карьеры были заполнены водой и превратились в озера, а на огромных заброшенных территориях появились лесонасаждения и были построены ветряные и солнечные парки, превратившие их в новые энергетические ландшафты. Первые ветряные парки были построены в Лужице в 1990-х годах на заброшенных участках горнодобывающих предприятий и послужили основой для выработки электроэнергии из возобновляемых источников. С 2011 года на фоне ускоренного преобразования энергетики Германии стали появляться новые энергетические проекты. Однако разработка этих проектов проходила уже в других условиях, так как заброшенные горнопромышленные районы к этому времени уже были частично отвоеваны природой и сегодня являются местом обитания множества охраняемых видов птиц. Развитию этой тенденции способствовало учреждение группы компаний Internationale Bauausstellung, поддерживающей идею социального возрождения путем формирования новых ландшафтов. Несмотря на новые социальные и экологические трудности эти проекты, поддерживаемые частными инвесторами, были реализованы без сопротивления со стороны общественности на участках, находящихся в собственности государственного предприятия, ответственного за санацию заброшенного горнопромышленного района. Эти проекты помогли сформировать новый и более благоприятный имидж горнопромышленных районов. Анализ проведенных ранее исследований и исследований экологического воздействия ветряных парков, а также качественные интервью с местными жителями и разными заинтересованными сторонами, участвующими в разработке проектов в сфере регенеративной энергии, способствуют лучшему пониманию развития новых ландшафтов в заброшенных горнопромышленных районах, в которых важную роль играют возобновляемые источники энергии.

*Энергетические ландшафты; бурого угольного район; заброшенный горнопромышленный район; возобновляемые источники энергии; Германия; новые страны*

## Résumé

### Les nouveaux paysages post-miniers de l'énergie dans le bassin de lignite de Basse Lusace (Allemagne)

Depuis la Réunification allemande les paysages des bassins de lignite d'Allemagne de l'Est, façonnés par l'exploitation à ciel ouvert, ont connu une profonde transformation résultant de la fermeture de la plupart des mines. Tandis que des lacs se sont constitués dans les anciennes excavations, d'immenses surfaces de friches minières ont été reboisées ou utilisées pour implanter des fermes éoliennes et des parcs photovoltaïques à l'origine de nouveaux paysages de l'énergie. Les premiers parcs éoliens réalisés dans les années 1990 se sont implantés sur des friches minières qui sont devenues des ressources potentielles pour l'exploitation des énergies renouvelables. Avec l'accélération de la politique de transition énergétique depuis 2011 de nouveaux projets de *repowering* ont été lancés. Ces projets se sont développés dans un contexte différent parce que les transformations des friches minières en voie de reconquête par la nature en ont fait des espaces d'accueil d'oiseaux migrateurs protégés. Cette évolution a été favorisée par la mise en place d'une Exposition Internationale d'Architecture paysagère destinée à favoriser l'idée d'un renouveau social par la construction de nouveaux paysages. Malgré les nouveaux enjeux environnementaux et sociaux, ces projets portés par des opérateurs privés ont été réalisés sans opposition de la population sur des terrains appartenant à une société publique responsable de la réhabilitation des mines. Ils ont permis de donner une nouvelle image et de nouvelles valeurs aux paysages issus de l'exploitation minière. L'analyse de recherches précédentes et d'études d'impact sur l'implantation des parcs éoliens, ainsi qu'une enquête qualitative menée auprès de la population locale et de différents acteurs des projets d'énergie renouvelable permet de comprendre le processus de transformation de paysages miniers en paysages de succession minière où les énergies renouvelables occupent une place essentielle.

*Paysages de l'énergie; bassin de lignite; paysage de succession minière; énergie renouvelable; Allemagne; nouveaux Länder*